

DATA SHEET

For a complete data sheet, please also download:

- The IC06 74HC/HCT/HCU/HCMOS Logic Family Specifications
- The IC06 74HC/HCT/HCU/HCMOS Logic Package Information
- The IC06 74HC/HCT/HCU/HCMOS Logic Package Outlines

74HC/HCT4351

8-channel analog multiplexer/demultiplexer with latch

Product specification
File under Integrated Circuits, IC06

December 1990

8-channel analog multiplexer/demultiplexer with latch

74HC/HCT4351

FEATURES

- Wide analog input voltage range:
± 5 V
- Low "ON" resistance:
80 Ω (typ.) at $V_{CC} - V_{EE} = 4.5$ V
70 Ω (typ.) at $V_{CC} - V_{EE} = 6.0$ V
60 Ω (typ.) at $V_{CC} - V_{EE} = 9.0$ V
- Logic level translation: to enable 5 V logic to communicate with ± 5 V analog signals
- Typical "break before make" built in
- Address latches provided
- Output capability: non-standard
- I_{CC} category: MSI

GENERAL DESCRIPTION

The 74HC/HCT4351 are high-speed Si-gate CMOS devices. They are specified in compliance with JEDEC standard no. 7A.

The 74HC/HCT4351 are 8-channel analog multiplexers/demultiplexers with three select inputs (S_0 to S_2), two enable inputs (\bar{E}_1 and E_2), a latch enable input (LE), eight independent inputs/outputs (Y_0 to Y_7) and a common input/output (Z).

With \bar{E}_1 LOW and E_2 is HIGH, one of the eight switches is selected (low impedance ON-state) by S_0 to S_2 . The data at the select inputs may be latched by using the active LOW latch enable input (LE). When LE is HIGH the latch is transparent. When either of the two enable inputs, \bar{E}_1 (active LOW) and E_2 (active HIGH), is inactive, all 8 analog switches are turned off.

V_{CC} and GND are the supply voltage pins for the digital control inputs (S_0 to S_2 , \bar{E}_1 , E_2). The V_{CC} to GND ranges are 2.0 to 10.0 V for HC and 4.5 to 5.5 V for HCT. The analog inputs/outputs (Y_0 to Y_7 , and Z) can swing between V_{CC} as a positive limit and V_{EE} as a negative limit.

$V_{CC} - V_{EE}$ may not exceed 10.0 V.

For operation as a digital multiplexer/demultiplexer, V_{EE} is connected to GND (typically ground).

QUICK REFERENCE DATA

$V_{EE} = GND = 0$ V; $T_{amb} = 25$ °C; $t_r = t_f = 6$ ns

| SYMBOL | PARAMETER | CONDITIONS | TYPICAL | | UNIT |
|---------------------|--|---|---------|-----|------|
| | | | HC | HCT | |
| t_{PZH} / t_{PZL} | turn "ON" time \bar{E}_1 , E_2 or S_n to V_{os} | $C_L = 15$ pF; $R_L = 1$ kΩ; $V_{CC} = 5$ V | 27 | 35 | ns |
| t_{PHZ} / t_{PLZ} | turn "OFF" time \bar{E}_1 , E_2 or S_n to V_{os} | | 21 | 23 | ns |
| C_I | input capacitance | | 3.5 | 3.5 | pF |
| C_{PD} | power dissipation capacitance per switch | notes 1 and 2 | 25 | 25 | pF |
| C_S | max. switch capacitance independent (Y) common (Z) | | 5 | 5 | pF |
| | | | 25 | 25 | pF |

Notes

1. C_{PD} is used to determine the dynamic power dissipation (P_D in μ W):

$$P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum \{(C_L + C_S) \times V_{CC}^2 \times f_o\}$$

where:

f_i = input frequency in MHz

f_o = output frequency in MHz

C_L = output load capacitance in pF

C_S = max. switch capacitance in pF

$\sum \{(C_L + C_S) \times V_{CC}^2 \times f_o\}$ = sum of outputs

V_{CC} = supply voltage in V

2. For HC the condition is $V_I = GND$ to V_{CC}
For HCT the condition is $V_I = GND$ to $V_{CC} - 1.5$ V

ORDERING INFORMATION

See "74HC/HCT/HCU/HCMOS Logic Package Information".

8-channel analog multiplexer/demultiplexer with latch

74HC/HCT4351

PIN DESCRIPTION

| PIN NO. | SYMBOL | NAME AND FUNCTION |
|----------------------------|----------------|---------------------------------|
| 4 | Z | common |
| 3, 14 | n.c. | not connected |
| 7 | \bar{E}_1 | enable input (active LOW) |
| 8 | E_2 | enable input (active HIGH) |
| 9 | V_{EE} | negative supply voltage |
| 10 | GND | ground (0 V) |
| 11 | \bar{LE} | latch enable input (active LOW) |
| 15, 13, 12 | S_0 to S_2 | select inputs |
| 17, 18, 19, 16, 1, 6, 2, 5 | Y_0 to Y_7 | independent inputs/outputs |
| 20 | V_{CC} | positive supply voltage |

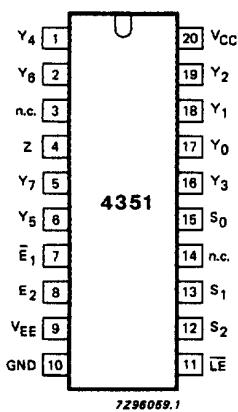


Fig.1 Pin configuration.

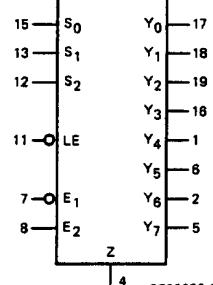


Fig.2

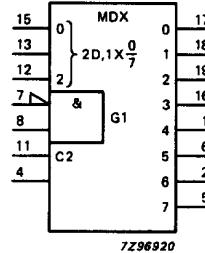


Fig.3 IEC logic symbol.

8-channel analog multiplexer/demultiplexer with latch

74HC/HCT4351

FUNCTION TABLE

| INPUTS | | | | | | CHANNEL ON |
|-------------|-------|------------|-------|-------|-------|---------------|
| \bar{E}_1 | E_2 | \bar{LE} | S_2 | S_1 | S_0 | |
| H | X | X | X | X | X | none |
| X | L | X | X | X | X | none |
| L | H | H | L | L | L | Y_0 |
| L | H | H | L | L | H | Y_1 |
| L | H | H | L | H | L | Y_2 |
| L | H | H | L | H | H | Y_3 |
| L | H | H | H | L | L | Y_4 |
| L | H | H | H | L | H | Y_5 |
| L | H | H | H | H | L | Y_6 |
| L | H | H | H | H | H | Y_7 |
| L | H | L | X | X | X | (1) |
| X | X | ↓ | X | X | X | (2) |

Notes

1. Last selected channel "ON".
2. Selected channels latched.
3. H = HIGH voltage level
L = LOW voltage level
X = don't care
↓ = HIGH-to-LOW \bar{LE} transition

APPLICATIONS

- Analog multiplexing and demultiplexing
- Digital multiplexing and demultiplexing
- Signal gating

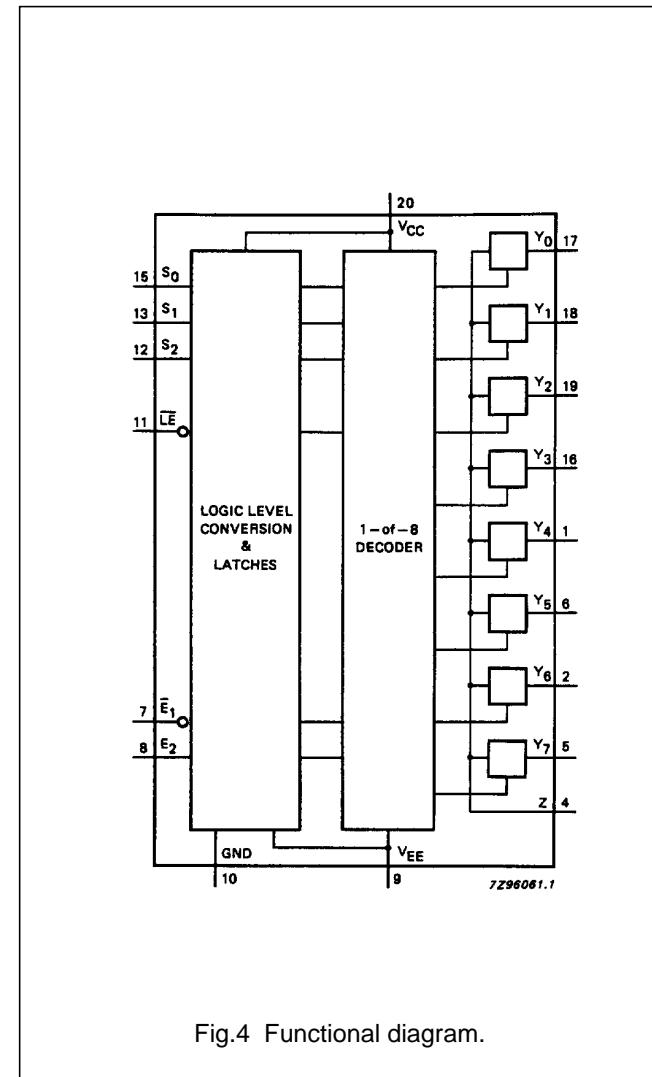


Fig.4 Functional diagram.

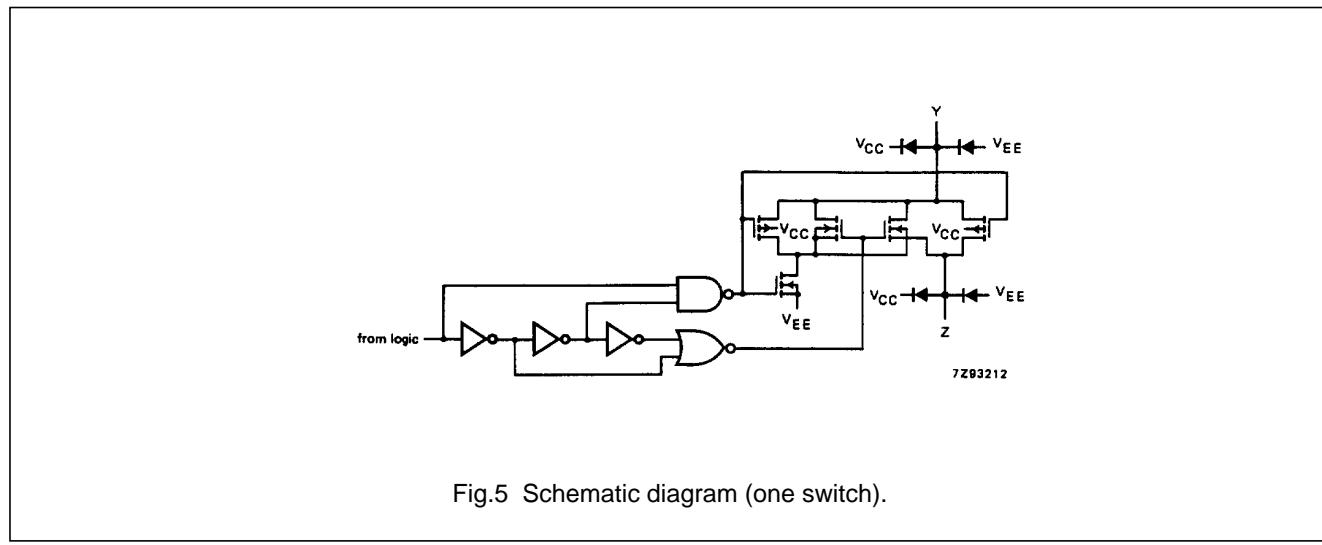


Fig.5 Schematic diagram (one switch).

8-channel analog multiplexer/demultiplexer with latch

74HC/HCT4351

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages are referenced to V_{EE} = GND (ground = 0 V)

| SYMBOL | PARAMETER | MIN. | MAX. | UNIT | CONDITIONS |
|---------------------------|--------------------------------|------|-------|------|---|
| V_{CC} | DC supply voltage | -0.5 | +11.0 | V | |
| $\pm I_{IK}$ | DC digital input diode current | | 20 | mA | for $V_I < -0.5$ V or $V_I > V_{CC} + 0.5$ V |
| $\pm I_{SK}$ | DC switch diode current | | 20 | mA | for $V_S < -0.5$ V or $V_S > V_{CC} + 0.5$ V |
| $\pm I_S$ | DC switch current | | 25 | mA | for -0.5 V < V_S < $V_{CC} + 0.5$ V |
| $\pm I_{EE}$ | DC V_{EE} current | | 20 | mA | |
| $\pm I_{CC}; \pm I_{GND}$ | DC V_{CC} or GND current | | 50 | mA | |
| T_{stg} | storage temperature range | -65 | +150 | °C | |
| P_{tot} | power dissipation per package | | | | for temperature range: -40 to +125 °C 74HC/HCT |
| | plastic DIL | | 750 | mW | above +70 °C: derate linearly with 12 mW/K |
| | plastic mini-pack (SO) | | 500 | mW | above +70 °C: derate linearly with 8 mW/K |
| P_S | power dissipation per switch | | 100 | mW | |

Note to ratings

1. To avoid drawing V_{CC} current out of terminal Z, when switch current flows in terminals Y_n , the voltage drop across the bidirectional switch must not exceed 0.4 V. If the switch current flows into terminal Z, no V_{CC} current will flow out of terminals Y_n . In this case there is no limit for the voltage drop across the switch, but the voltages at Y_n and Z may not exceed V_{CC} or V_{EE} .

RECOMMENDED OPERATING CONDITIONS

| SYMBOL | PARAMETER | 74HC | | | 74HCT | | | UNIT | CONDITIONS |
|------------|---------------------------------------|----------|------|---------------------------|----------|------|----------|------|---|
| | | min. | typ. | max. | min. | typ. | max. | | |
| V_{CC} | DC supply voltage V_{CC} -GND | 2.0 | 5.0 | 10.0 | 4.5 | 5.0 | 5.5 | V | see Figs 6 and 7 |
| V_{CC} | DC supply voltage V_{CC} - V_{EE} | 2.0 | 5.0 | 10.0 | 2.0 | 5.0 | 10.0 | V | see Figs 6 and 7 |
| V_I | DC input voltage range | GND | | V_{CC} | GND | | V_{CC} | V | |
| V_S | DC switch voltage range | V_{EE} | | V_{CC} | V_{EE} | | V_{CC} | V | |
| T_{amb} | operating ambient temperature range | -40 | | +85 | -40 | | +85 | °C | see DC and AC CHARACTERISTICS |
| T_{amb} | operating ambient temperature range | -40 | | +125 | -40 | | +125 | °C | |
| t_r, t_f | input rise and fall times | | 6.0 | 1000 500 400 250 | | 6.0 | 500 | ns | $V_{CC} = 2.0$ V $V_{CC} = 4.5$ V $V_{CC} = 6.0$ V $V_{CC} = 10.0$ V |

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74HC/HCT4351

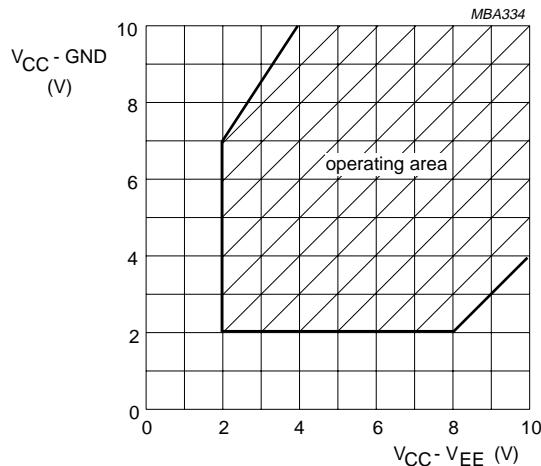


Fig.6 Guaranteed operating area as a function of the supply voltages for 74HC4351.

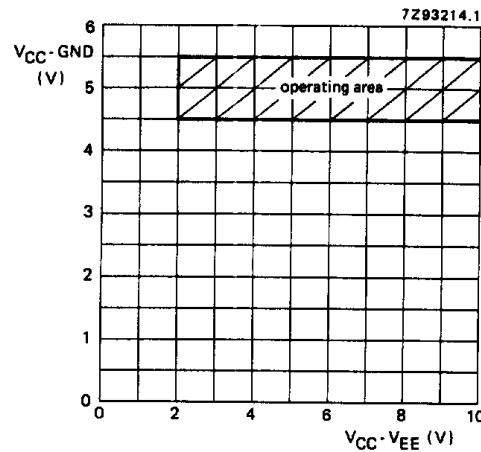


Fig.7 Guaranteed operating area as a function of the supply voltages for 74HCT4351.

DC CHARACTERISTICS FOR 74HC/HCT

For 74HC: $V_{CC} - GND$ or $V_{CC} - V_{EE} = 2.0, 4.5, 6.0$ and 9.0 V

For 74HCT: $V_{CC} - GND = 4.5$ and 5.5 V ; $V_{CC} - V_{EE} = 2.0, 4.5, 6.0$ and 9.0 V

| SYMBOL | PARAMETER | T_{amb} ($^{\circ}\text{C}$) | | | | | | UNIT | TEST CONDITIONS | | | | | | | | | | |
|-----------------|---|----------------------------------|------|------------|------|-------------|------|----------|------------------------|------------------------|-------------------------------------|----------------------|----------------------|--|--|--|--|--|--|
| | | 74HC/HCT | | | | | | | V _{CC} (V) | V _{EE} (V) | I _S (μA) | V _{IS} | V _I | | | | | | |
| | | +25 | | -40 to +85 | | -40 to +125 | | | | | | | | | | | | | |
| | | min. | typ. | max. | min. | max. | min. | | | | | | | | | | | | |
| R_{ON} | ON resistance (rail) | — | 100 | 180 | — | 225 | — | Ω | 2.0 | 0 | 100 | V_{CC} to V_{EE} | V_{IN} or V_{IL} | | | | | | |
| | | 90 | 160 | — | 200 | 240 | 270 | Ω | 4.5 | 0 | 1000 | | | | | | | | |
| | | 70 | 130 | — | 165 | 195 | 240 | Ω | 6.0 | 0 | 1000 | | | | | | | | |
| | | | | | | | 4.5 | Ω | —4.5 | 1000 | | | | | | | | | |
| R_{ON} | ON resistance (rail) | 150 | — | — | 175 | — | 210 | Ω | 2.0 | 0 | 100 | V_{EE} | V_{IH} or V_{IL} | | | | | | |
| | | 80 | 140 | — | 150 | 180 | 210 | Ω | 4.5 | 0 | 1000 | | | | | | | | |
| | | 70 | 120 | — | 130 | 160 | 180 | Ω | 6.0 | 0 | 1000 | | | | | | | | |
| | | 60 | 105 | — | — | 130 | 160 | Ω | 4.5 | —4.5 | 1000 | | | | | | | | |
| R_{ON} | ON resistance (rail) | 150 | — | — | 200 | — | 240 | Ω | 2.0 | 0 | 100 | V_{CC} | V_{IH} or V_{IL} | | | | | | |
| | | 90 | 160 | — | 175 | — | 210 | Ω | 4.5 | 0 | 1000 | | | | | | | | |
| | | 80 | 140 | — | 150 | 180 | 210 | Ω | 6.0 | 0 | 1000 | | | | | | | | |
| | | 65 | 120 | — | 150 | 180 | 210 | Ω | 4.5 | —4.5 | 1000 | | | | | | | | |
| ΔR_{ON} | maximum Δ ON resistance between any two channels | — | 9 | — | — | — | — | Ω | 2.0 | 0 | — | V_{CC} to V_{EE} | V_{IH} or V_{IL} | | | | | | |
| | | 8 | — | — | — | — | — | Ω | 4.5 | 0 | — | | | | | | | | |
| | | 6 | — | — | — | — | — | Ω | 6.0 | 0 | — | | | | | | | | |
| | | | | | | | — | Ω | 4.5 | —4.5 | — | | | | | | | | |

Notes to DC characteristics

- At supply voltages ($V_{CC} - V_{EE}$) approaching 2.0 V, the analog switch ON-resistance becomes extremely non-linear. There it is recommended that these devices be used to transmit digital signals only, when using these supply voltages.
- For test circuit measuring R_{ON} see Fig.8.

8-channel analog multiplexer/demultiplexer with latch

74HC/HCT4351

DC CHARACTERISTICS FOR 74HC

Voltages are referenced to GND (ground = 0 V)

| SYMBOL | PARAMETER | T _{amb} (°C) | | | | | | UNIT | TEST CONDITIONS | | | | | | | |
|-----------------|--|---------------------------|--------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|------------------------|--------------------------|----------------|--|--|--|--|--|
| | | 74HC | | | | | | | V _{CC} (V) | V _{EE} (V) | V _I | OTHER | | | | |
| | | +25 | | | −40 to +85 | | −40 to +125 | | | | | | | | | |
| | | min. | typ. | max. | min. | max. | min. | max. | | | | | | | | |
| V _{IH} | HIGH level input voltage | 1.5 3.15 4.2 6.3 | 1.2 2.4 3.2 4.7 | | 1.5 3.15 4.2 6.3 | | 1.5 3.15 4.2 6.3 | | V | 2.0 4.5 6.0 9.0 | | | | | | |
| V _{IL} | LOW level input voltage | | 0.8 2.1 2.8 4.3 | 0.5 1.35 1.8 2.7 | | 0.5 1.35 1.8 2.7 | | 0.5 1.35 1.8 2.7 | V | 2.0 4.5 6.0 9.0 | | | | | | |
| ±I _I | input leakage current | | | 0.1 0.2 | | 1.0 2.0 | | 1.0 2.0 | µA | 6.0 10.0 | 0 0 | V _{CC} or GND | | | | |
| ±I _S | analog switch OFF-state current per channel | | | 0.1 | | 1.0 | | 1.0 | µA | 10.0 | 0 | V _{IH} or V _{IL} $ I_S = V_{CC} - V_{EE}$ (see Fig.10) | | | | |
| ±I _S | analog switch OFF-state current all channels | | | 0.4 | | 4.0 | | 4.0 | µA | 10.0 | 0 | V _{IH} or V _{IL} $ I_S = V_{CC} - V_{EE}$ (see Fig.10) | | | | |
| ±I _S | analog switch ON-state current | | | 0.4 | | 4.0 | | 4.0 | µA | 10.0 | 0 | V _{IH} or V _{IL} $ I_S = V_{CC} - V_{EE}$ (see Fig.11) | | | | |
| I _{CC} | quiescent supply current | | | 8.0 16.0 | | 80.0 160.0 | | 160.0 320.0 | µA | 6.0 10.0 | 0 0 | V _{CC} or GND $V_{IS} = V_{EE}$ or V_{CC} ; $V_{OS} = V_{CC}$ or V_{EE} | | | | |

8-channel analog multiplexer/demultiplexer with latch

74HC/HCT4351

AC CHARACTERISTICS FOR 74HC

GND = 0 V; $t_r = t_f = 6$ ns; $C_L = 50$ pF

| SYMBOL | PARAMETER | T_{amb} (°C) | | | | | | UNIT | TEST CONDITIONS | | | | | |
|--------------------|--|----------------|----------------------|-----------------------|------------|-----------------------|-------------|-----------------------|------------------------|--------------------------|---------------------|---|--|--|
| | | 74HC | | | | | | | V _{CC} (V) | V _{EE} (V) | OTHER | | | |
| | | +25 | | | -40 to +85 | | -40 to +125 | | | | | | | |
| | | min. | typ. | max. | min. | max. | min. | max. | | | | | | |
| t_{PHL}/ t_{PLH} | propagation delay V_{is} to V_{os} | | 14 5 4 4 | 60 12 10 8 | | 75 15 13 10 | | 90 18 15 12 | ns | 2.0 4.5 6.0 4.5 | 0 0 0 -4.5 | $R_L = \infty$; $C_L = 50$ pF (see Fig.17) | | |
| t_{PZH}/ t_{PZL} | turn "ON" time \bar{E}_1 to V_{os} | | 85 31 25 28 | 300 60 51 55 | | 375 75 64 69 | | 450 90 77 83 | ns | 2.0 4.5 6.0 4.5 | 0 0 0 -4.5 | $R_L = 1$ kΩ; $C_L = 50$ pF (see Fig.18) | | |
| t_{PZH}/ t_{PZL} | turn "ON" time E_2 to V_{os} | | 85 31 25 25 | 300 60 51 55 | | 375 75 64 69 | | 450 90 77 83 | ns | 2.0 4.5 6.0 4.5 | 0 0 0 -4.5 | $R_L = 1$ kΩ; $C_L = 50$ pF (see Fig.18) | | |
| t_{PZH}/ t_{PZL} | turn "ON" time $\bar{L}E$ to V_{os} | | 91 33 26 27 | 300 60 51 55 | | 375 75 64 69 | | 450 90 77 83 | ns | 2.0 4.5 6.0 4.5 | 0 0 0 -4.5 | $R_L = 1$ kΩ; $C_L = 50$ pF (see Fig.18) | | |
| t_{PZH}/ t_{PZL} | turn "ON" time S_n to V_{os} | | 88 32 26 25 | 300 60 51 50 | | 375 75 64 63 | | 450 90 77 75 | ns | 2.0 4.5 6.0 4.5 | 0 0 0 -4.5 | $R_L = 1$ kΩ; $C_L = 50$ pF (see Fig.18) | | |
| t_{PHZ}/ t_{PLZ} | turn "OFF" time \bar{E}_1 to V_{os} | | 69 25 20 20 | 250 50 43 40 | | 315 63 54 50 | | 375 75 64 60 | ns | 2.0 4.5 6.0 4.5 | 0 0 0 -4.5 | $R_L = 1$ kΩ; $C_L = 50$ pF (see Fig.18) | | |
| t_{PHZ}/ t_{PLZ} | turn "OFF" time E_2 to V_{os} | | 72 26 21 19 | 250 50 43 40 | | 315 63 54 50 | | 375 75 64 60 | ns | 2.0 4.5 6.0 4.5 | 0 0 0 -4.5 | $R_L = 1$ kΩ; $C_L = 50$ pF (see Fig.18) | | |
| t_{PHZ}/ t_{PLZ} | turn "OFF" time $\bar{L}E$ to V_{os} | | 83 30 24 26 | 275 55 47 45 | | 345 69 59 56 | | 415 83 71 68 | ns | 2.0 4.5 6.0 4.5 | 0 0 0 -4.5 | $R_L = 1$ kΩ; $C_L = 50$ pF (see Fig.18) | | |
| t_{PHZ}/ t_{PLZ} | turn "OFF" time S_n to V_{os} | | 80 29 23 24 | 275 55 47 48 | | 345 69 59 60 | | 415 83 71 72 | ns | 2.0 4.5 6.0 4.5 | 0 0 0 -4.5 | $R_L = 1$ kΩ; $C_L = 50$ pF (see Fig.18) | | |

8-channel analog multiplexer/demultiplexer
with latch

74HC/HCT4351

| SYMBOL | PARAMETER | T _{amb} (°C) | | | | | | | UNIT | TEST CONDITIONS | | | | | | |
|-----------------|--|-----------------------|----------------------|------|------------|-----------------------|-------------|-----------------------|------|--------------------------|------------------------|--|--|--|--|--|
| | | 74HC | | | | | | | | V _{CC} (V) | V _{EE} (V) | OTHER | | | | |
| | | +25 | | | −40 to +85 | | −40 to +125 | | | | | | | | | |
| | | min. | typ. | max. | min. | max. | min. | max. | | | | | | | | |
| t _{su} | set-up time S _n to \overline{LE} | 60 12 10 18 | 17 6 5 9 | | | 75 15 13 23 | | 90 18 15 27 | ns | 2.0 4.5 6.0 4.5 | 0 0 0 −4.5 | R _L = 1 kΩ; C _L = 50 pF (see Fig.19) | | | | |
| t _h | hold time S _n to \overline{LE} | 5 5 5 5 | −8 −3 −2 −4 | | | 5 5 5 5 | | 5 5 5 5 | ns | 2.0 4.5 6.0 4.5 | 0 0 0 −4.5 | R _L = 1 kΩ; C _L = 50 pF (see Fig.19) | | | | |
| t _w | \overline{LE} minimum pulse width HIGH | 100 20 17 25 | 11 1 3 7 | | | 125 25 21 31 | | 150 30 26 38 | ns | 2.0 4.5 6.0 4.5 | 0 0 0 −4.5 | R _L = 1 kΩ; C _L = 50 pF (see Fig.19) | | | | |

8-channel analog multiplexer/demultiplexer with latch

74HC/HCT4351

DC CHARACTERISTICS FOR 74HCT

Voltages are referenced to GND (ground = 0)

| SYMBOL | PARAMETER | T _{amb} (°C) | | | | | | UNIT | TEST CONDITIONS | | | | | | | |
|------------------|---|-----------------------|------|-------------|------|---------------|------|----------------|---------------------|---------------------|----------------|--|--|--|--|--|
| | | 74HCT | | | | | | | V _{CC} (V) | V _{EE} (V) | V _I | OTHER | | | | |
| | | +25 | | -40 to +85 | | -40 to +125 | | | | | | | | | | |
| | | min. | typ. | max. | min. | max. | min. | max. | | | | | | | | |
| V _{IH} | HIGH level input voltage | 2.0 | 1.6 | | 2.0 | | 2.0 | | V | 4.5 to 5.5 | | | | | | |
| V _{IL} | LOW level input voltage | | 1.2 | 0.8 | | 0.8 | | 0.8 | V | 4.5 to 5.5 | | | | | | |
| ±I _I | input leakage current | | | 0.1 | | 1.0 | | 1.0 | µA | 5.5 | 0 | V _{CC} or GND | | | | |
| ±I _S | analog switch OFF-state current per channel | | | 0.1 | | 1.0 | | 1.0 | µA | 10.0 | 0 | V _{IH} or V _{IL} | | | | |
| ±I _S | analog switch OFF-state current all channels | | | 0.4 | | 4.0 | | 4.0 | µA | 10.0 | 0 | V _{IH} or V _{IL} | | | | |
| ±I _S | analog switch ON-state current | | | 0.4 | | 4.0 | | 4.0 | µA | 10.0 | 0 | V _{IH} or V _{IL} | | | | |
| I _{CC} | quiescent supply current | | | 8.0 16.0 | | 80.0 160.0 | | 160.0 320.0 | µA | 5.5 5.0 | 0 -5.0 | V _{CC} or GND | | | | |
| ΔI _{CC} | additional quiescent supply current per input pin for unit load coefficient is 1 (note 1) | | 100 | 360 | | 450 | | 490 | µA | 4.5 to 5.5 | 0 | V _{CC} -2.1 V | | | | |
| | | | | | | | | | | | | other inputs at V _{CC} or GND | | | | |

Note to HCT types

1. The value of additional quiescent supply current (ΔI_{CC}) for a unit load of 1 is given here.

To determine ΔI_{CC} per input, multiply this value by the unit load coefficient shown in the table below.

| INPUT | UNIT LOAD COEFFICIENT |
|---------------------------------|-----------------------|
| Ē ₁ , E ₂ | 0.50 |
| S _n | 0.50 |
| LE | 1.5 |

8-channel analog multiplexer/demultiplexer with latch

74HC/HCT4351

AC CHARACTERISTICS FOR 74HCT

GND = 0 V; $t_r = t_f = 6$ ns; $C_L = 50$ pF

| SYMBOL | PARAMETER | T_{amb} (°C) | | | | | | UNIT | TEST CONDITIONS | | | | | |
|--------------------|--|----------------|----------|------|------------|------|-------------|------|------------------------|------------------------|---|--|--|--|
| | | 74HCT | | | | | | | V _{CC} (V) | V _{EE} (V) | OTHER | | | |
| | | +25 | | | -40 to +85 | | -40 to +125 | | | | | | | |
| | | min. | typ. | max. | min. | max. | min. | max. | | | | | | |
| t_{PHL}/ t_{PLH} | propagation delay V_{is} to V_{os} | 6 4 | 12 8 | | 15 10 | | 18 12 | ns | 4.5 4.5 | 0 -4.5 | $R_L = \infty$; $C_L = 50$ pF (see Fig.17) | | | |
| t_{PZH}/ t_{PZL} | turn "ON" time \bar{E}_1 to V_{os} | 40 31 | 75 60 | | 94 75 | | 113 90 | ns | 4.5 4.5 | 0 -4.5 | $R_L = 1$ kΩ; $C_L = 50$ pF (see Fig.18) | | | |
| t_{PZH}/ t_{PZL} | turn "ON" time E_2 to V_{os} | 35 26 | 70 50 | | 88 63 | | 105 75 | ns | 4.5 4.5 | 0 -4.5 | $R_L = 1$ kΩ; $C_L = 50$ pF (see Fig.18) | | | |
| t_{PZH}/ t_{PZL} | turn "ON" time $\bar{L}E$ to V_{os} | 42 37 | 75 60 | | 94 75 | | 113 90 | ns | 4.5 4.5 | 0 -4.5 | $R_L = 1$ kΩ; $C_L = 50$ pF (see Fig.18) | | | |
| t_{PZH}/ t_{PZL} | turn "ON" time S_n to V_{os} | 39 30 | 75 60 | | 94 75 | | 113 90 | ns | 4.5 4.5 | 0 -4.5 | $R_L = 1$ kΩ; $C_L = 50$ pF (see Fig.18) | | | |
| t_{PHZ}/ t_{PLZ} | turn "OFF" time \bar{E}_1 to V_{os} | 27 20 | 55 40 | | 69 50 | | 83 60 | ns | 4.5 4.5 | 0 -4.5 | $R_L = 1$ kΩ; $C_L = 50$ pF (see Fig.18) | | | |
| t_{PHZ}/ t_{PLZ} | turn "OFF" time E_2 to V_{os} | 32 26 | 60 50 | | 75 63 | | 90 75 | ns | 4.5 4.5 | 0 -4.5 | $R_L = 1$ kΩ; $C_L = 50$ pF (see Fig.18) | | | |
| t_{PHZ}/ t_{PLZ} | turn "OFF" time $\bar{L}E$ to V_{os} | 33 30 | 60 55 | | 75 69 | | 90 83 | ns | 4.5 4.5 | 0 -4.5 | $R_L = 1$ kΩ; $C_L = 50$ pF (see Fig.18) | | | |
| t_{PHZ}/ t_{PLZ} | turn "OFF" time S_n to V_{os} | 33 29 | 65 55 | | 81 69 | | 98 83 | ns | 4.5 4.5 | 0 -4.5 | $R_L = 1$ kΩ; $C_L = 50$ pF (see Fig.18) | | | |
| t_{su} | set-up time S_n to $\bar{L}E$ | 12 14 | 6 7 | | 15 18 | | 18 21 | ns | 4.5 4.5 | 0 -4.5 | $R_L = 1$ kΩ; $C_L = 50$ pF (see Fig.19) | | | |
| t_h | hold time S_n to $\bar{L}E$ | 5 5 | -1 -2 | | 5 5 | | 5 5 | ns | 4.5 4.5 | 0 -4.5 | $R_L = 1$ kΩ; $C_L = 50$ pF (see Fig.19) | | | |
| t_w | $\bar{L}E$ minimum pulse width HIGH | 25 25 | 13 13 | | 31 31 | | 38 38 | ns | 4.5 4.5 | 0 -4.5 | $R_L = 1$ kΩ; $C_L = 50$ pF (see Fig.19) | | | |

8-channel analog multiplexer/demultiplexer with latch

74HC/HCT4351

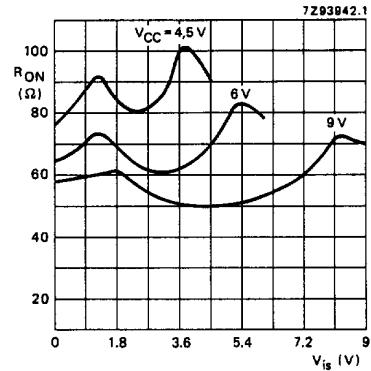
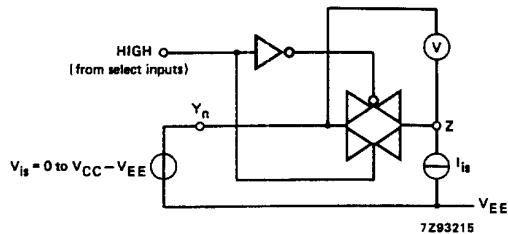


Fig.9 Typical R_{ON} as a function of input voltage V_{IS} for $V_{IS} = 0$ to $V_{CC} - V_{EE}$.

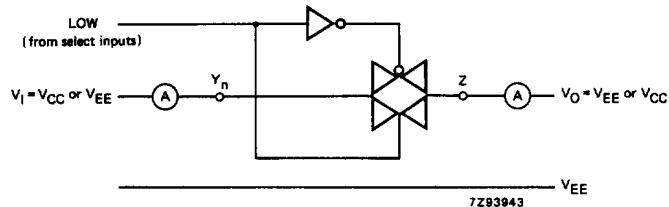


Fig.10 Test circuit for measuring OFF-state current.

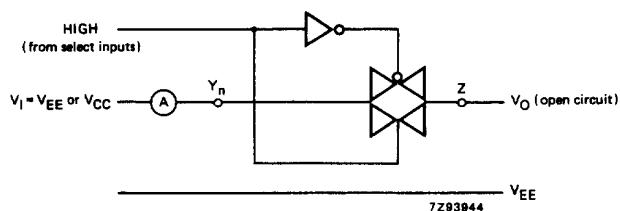


Fig.11 Test circuit for measuring ON-state current.

8-channel analog multiplexer/demultiplexer with latch

74HC/HCT4351

ADDITIONAL AC CHARACTERISTICS FOR 74HC/HCT

Recommended conditions and typical values

GND = 0 V; T_{amb} = 25 °C

| SYMBOL | PARAMETER | typ. | UNIT | V_{CC} (V) | V_{EE} (V) | $V_{is(p-p)}$ (V) | CONDITIONS |
|-------------|---|--------------|------------|-----------------|-----------------|----------------------|---|
| | sine-wave distortion $f = 1$ kHz | 0.04 0.02 | % % | 2.25 4.5 | -2.25 -4.5 | 4.0 8.0 | $R_L = 10$ kΩ; $C_L = 50$ pF (see Fig.14) |
| | sine-wave distortion $f = 10$ kHz | 0.12 0.06 | % % | 2.25 4.5 | -2.25 -4.5 | 4.0 8.0 | $R_L = 10$ kΩ; $C_L = 50$ pF (see Fig.14) |
| | switch "OFF" signal feed-through | -50 -50 | dB dB | 2.25 4.5 | -2.25 -4.5 | note 1 | $R_L = 600$ Ω; $C_L = 50$ pF (see Figs 12 and 15) |
| $V_{(p-p)}$ | crosstalk voltage between control and any switch (peak-to-peak value) | 120 220 | mV mV | 4.5 4.5 | 0 -4.5 | | $R_L = 600$ Ω; $C_L = 50$ pF; $f = 1$ MHz (E_1 , E_2 or S_n , square-wave between V_{CC} and GND, $t_r = t_f = 6$ ns) (see Fig.16) |
| f_{max} | minimum frequency response (-3dB) | 160 170 | MHz MHz | 2.25 4.5 | -2.25 -4.5 | note 2 | $R_L = 50$ Ω; $C_L = 10$ pF (see Figs 13 and 14) |
| C_S | maximum switch capacitance independent (Y) common (Z) | 5 25 | pF pF | | | | |

Notes to AC characteristics

1. Adjust input voltage V_{is} to 0 dBm level (0 dBm = 1 mW into 600 Ω).
2. Adjust input voltage V_{is} to 0 dBm level at V_{os} for 1 MHz (0 dBm = 1 mW into 50 Ω).

V_{is} is the input voltage at a Y_n or Z terminal, whichever is assigned as an input.

V_{os} is the output voltage at a Y_n or Z terminal, whichever is assigned as an output.

Test conditions:
 $V_{CC} = 4.5$ V; GND = 0 V; $V_{EE} = -4.5$ V;
 $R_L = 50$ Ω; $R_{source} = 1$ kΩ.

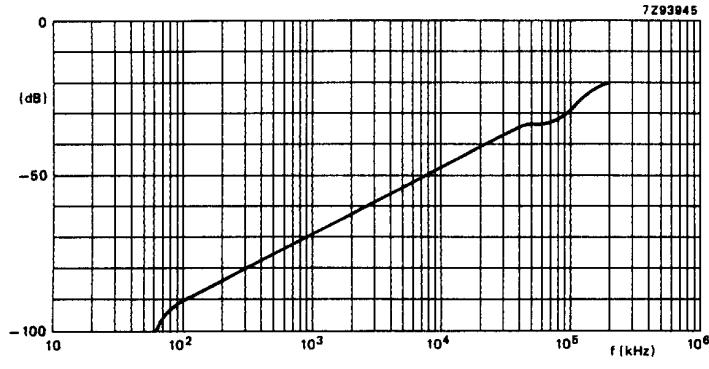


Fig.12 Typical switch "OFF" signal feed-through as a function of frequency.

8-channel analog multiplexer/demultiplexer with latch

74HC/HCT4351

Test conditions:
 $V_{CC} = 4.5$ V; GND = 0 V; $V_{EE} = -4.5$ V;
 $R_L = 50 \Omega$; $R_{source} = 1 \text{ k}\Omega$.

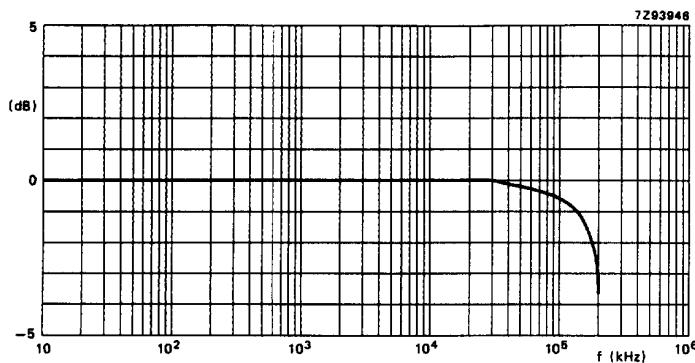


Fig.13 Typical frequency response.

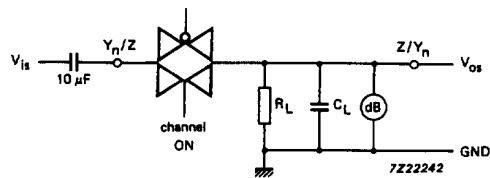


Fig.14 Test circuit for measuring sine-wave distortion and minimum frequency response.

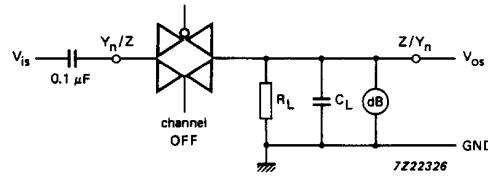
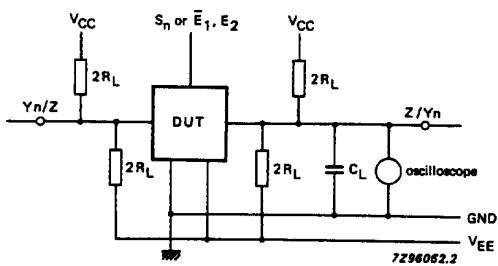


Fig.15 Test circuit for measuring switch "OFF" signal feed-through.



The crosstalk is defined as follows
(oscilloscope output):

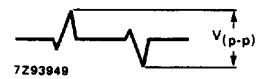


Fig.16 Test circuit for measuring crosstalk between control and any switch.

8-channel analog multiplexer/demultiplexer with latch

74HC/HCT4351

AC WAVEFORMS

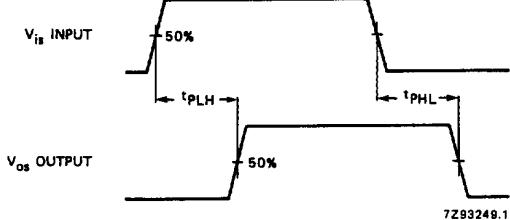
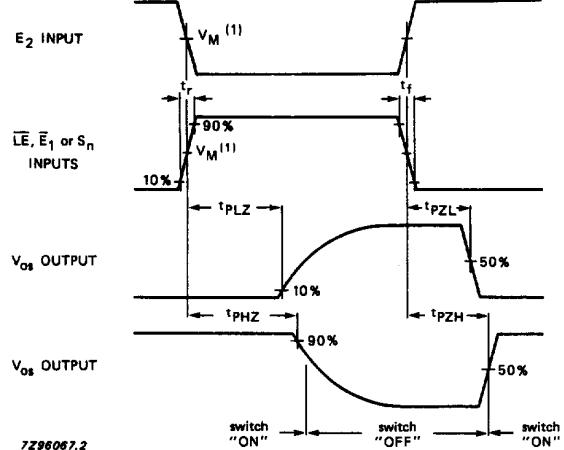
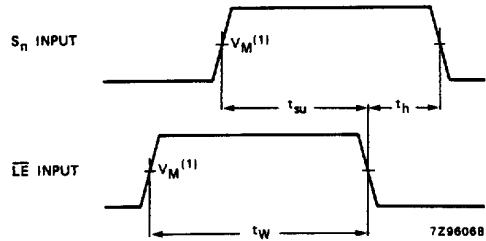


Fig.17 Waveforms showing the input (V_{is}) to output (V_{os}) propagation delays.



HC : $V_M = 50\%$; $V_I = \text{GND to } V_{CC}$.
HCT: $V_M = 1.3 \text{ V}$; $V_I = \text{GND to } 3 \text{ V}$.

Fig.18 Waveforms showing the turn-ON and turn-OFF times.



HC : $V_M = 50\%$; $V_I = \text{GND to } V_{CC}$.
HCT: $V_M = 1.3 \text{ V}$; $V_I = \text{GND to } 3 \text{ V}$.

Fig.19 Waveforms showing the set-up and hold times from S_n inputs to \overline{LE} input, and minimum pulse width of \overline{LE} .

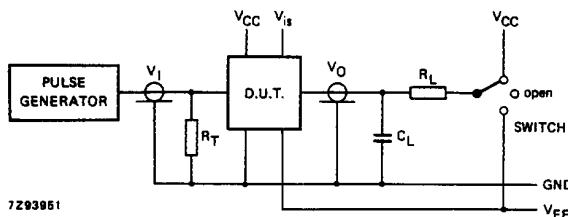
8-channel analog multiplexer/demultiplexer with latch

74HC/HCT4351

TEST CIRCUIT AND WAVEFORMS

Conditions

| TEST | SWITCH | V_{IS} |
|-----------|----------|----------|
| t_{PZH} | V_{EE} | V_{CC} |
| t_{PZL} | V_{CC} | V_{EE} |
| t_{PHZ} | V_{EE} | V_{CC} |
| t_{PLZ} | V_{CC} | V_{EE} |
| others | open | pulse |



| FAMILY | AMPLITUDE | V_M | $t_r; t_f$ | |
|--------|-----------|-------|---------------------------|-------|
| | | | $f_{max};$ PULSE WIDTH | OTHER |
| 74HC | V_{CC} | 50% | < 2 ns | 6 ns |
| 74HCT | 3.0 V | 1.3 V | < 2 ns | 6 ns |

C_L = load capacitance including jig and probe capacitance (see AC CHARACTERISTICS for values).

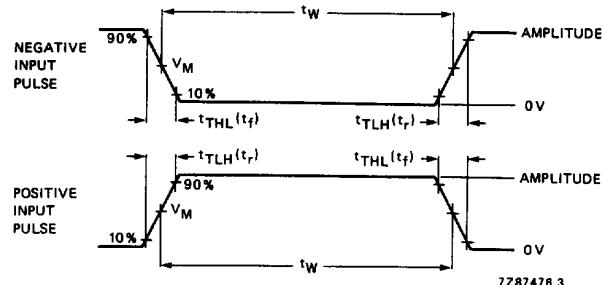
R_T = termination resistance should be equal to the output impedance Z_O of the pulse generator.

t_r = $t_f = 6$ ns; when measuring f_{max} , there is no constraint on t_r, t_f with 50% duty factor.

Fig.20 Test circuit for measuring AC performance.

Conditions

| TEST | SWITCH | V_{IS} |
|-----------|----------|----------|
| t_{PZH} | V_{EE} | V_{CC} |
| t_{PZL} | V_{CC} | V_{EE} |
| t_{PHZ} | V_{EE} | V_{CC} |
| t_{PLZ} | V_{CC} | V_{EE} |
| others | open | pulse |



| FAMILY | AMPLITUDE | V_M | $t_r; t_f$ | |
|--------|-----------|-------|---------------------------|-------|
| | | | $f_{max};$ PULSE WIDTH | OTHER |
| 74HC | V_{CC} | 50% | < 2 ns | 6 ns |
| 74HCT | 3.0 V | 1.3 V | < 2 ns | 6 ns |

C_L = load capacitance including jig and probe capacitance (see AC CHARACTERISTICS for values).

R_T = termination resistance should be equal to the output impedance Z_O of the pulse generator.

t_r = $t_f = 6$ ns; when measuring f_{max} , there is no constraint on t_r, t_f with 50% duty factor.

Fig.21 Input pulse definitions.

8-channel analog multiplexer/demultiplexer
with latch

74HC/HCT4351

PACKAGE OUTLINES

See "[74HC/HCT/HCU/HCMOS Logic Package Outlines](#)".